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ABSTRACT

Report is made of a study conducted to determine the adequacy of the diet of fourteen teen-age competitive swimmers. A three day meal record was compared with recommended daily allowance tables and other recommended minimum/ maximum amounts where such values are established. Areas of dietary deficiency are discussed with particular emphasis on how these deficiencies affect swimming performance. (JD)

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COMPUTER ASSISTED NUTRITIONAL ANALYSIS OF SELECTED SWIM TEAM MEMBERS

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The purpose of this study was to determine the adequacy of the diet of selected competitive team members of the City of Mobile Swim Association. The age range of the population was 13-19 for female swimmers and 13-18 for male swimmers.

A three-day meal record of all food and beverages consumed was selected as a means of determining the adequacy of the diet of the selected sample. A computer analysis of 25 variables was completed for each individual subject's three-day diet. The results were compared with recommended daily allowance tables and other recommended minimum/maximum amounts where such values are clearly established.

The results indicated 83% of the female swimmers observed were below the recommended amounts for calcium. Additionally, 66% of the observed female swimmers were low for iron and Vitamin A, while the intake of phosphorus, thiamine, and riboflavin was inadequate for 16%. The female swimmers had an adequate intake for six of the nutrients analyzed.

Fifty percent of the male swimmers' diets were inadequate in Vitamin A intake. Additionally, 12% had insufficient dietary intakes of phosphorus and iron and excessive intakes of cholesterol. Thiamine was lacking when compared to the recommended amounts in 25% of the male swimmers. The male swimmers had adequate intakes for seven of the nutrients analyzed. Males had a mean intake of 6001 kilocalories which is double the amount recommended for an average individual in that age group. The diets of two of the male team members indicated an intake of 8-9000 kilocalories per day.

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COMPUTER ASSISTED NUTRITIONAL ANALYSIS OF SELECTED SWIM TEAM MEMBERS

A great deal of information, and in many instances, misinformation, has been disseminated in the area of nutrition and sport. There is probably no other area of human nutrition that contains as much fallacious data. Fad diets and recommendation for all types of food supplements including protein, vitamins and minerals are very common among both coach and athlete, even down to the little league competitors. The National Academy of Science (3) has, however, established criteria for an average person in the United States who is moderately active. Many athletes are taller and heavier than the average; all are certainly more than moderately active. Nevertheless, the consensus among professional nutritionists and physicians is that, other than calories, the athlete in training needs the same amount of nutrients as the average person (4,5).

Short (4) monitored the diets of athletes in training at Syracuse. She reported at the Colgate Sport Medicine Symposium that, although caloric intakes were higher than average, other values fell within the normal range. The only exception was that women were low in iron. The current problem paralleled Short's study in that the investigators monitored the dietary intakes of selected members of Mobile Swim Association's swimming and diving team who were training from 4 to 5 hours per day - 7 days per week. However, the present study investigated individual diets rather than reporting only the means for various groups. The diets were monitored as to their nutritional adequacy and the information was used by the coach and athletes to determine if any dietary supplements were necessary. It is anticipated that this will become an ongoing longitudinal study.

Procedure

In the summer of 1979, the authors met with the swimmers and their coach to explain the procedures. A three-day meal record of all food and beverages consumed was kept by each swimmer. The subjects were trained in estimating the amount of food contained in individual servings. Prior to finalizing their diet records, the subjects were once again allowed to observe various food models and make any changes they felt were necessary. (Previous research by the investigators has established error limits of less than 10 percent in estimating volume/weight for individuals trained in this manner). The subjects were instructed to keep the record for both week days and weekends to allow a more accurate representation of their dietary histories.

Each diet was analyzed by a computer program written by the authors. The program calculates and prints the means for kilocalories, protein, fat, carbohydrates, 5 vitamins, 5 minerals, cholesterol, and selected fatty acids in the diet. In addition, the program calculates the percentage of total energy from protein, fat, carbohydrate, alcohol, linoleic acid, as well as the percentage of saturated fat and unsaturated fat.

Results

Table I presents the means along with the recommended daily allowance and or suggested minimum/maximum for both the male and female population. The mean for protein was approximately three times the recommended daily allowance for men and twice the recommended daily allowance for females. Sodium was 25 times the minimal daily need for males and 13 times for females, while both potassium and vitamin C greatly exceeded the RDA for both males and females. In fact, looking at mean figures for both males and females the group either met or exceeded the established criteria in all categories with the possible exception of iron for females and vitamin A for both groups. Both of these figures however, deviate by such a slight amount as to be considered well within the normal range. The kilocalories were approximately twice the value for their age group counterparts for males and approximately 50 percent more for females, when compared to United States Dietary Intake Findings (1). Thus, from this sample of young athletes consuming a high amount of calories, one might be led to believe that athletes in training may not need supplements.

Since means can often be deceiving, the diets were analyzed to determine what percent of the individuals were either deficient or exceeded the recommended daily allowance. Individuals were considered to be within the normal range if their dietary intake was plus or minus 10 percent of the RDA.

Table II reveals the percent of male swimmers found deficient in specific nutrients. Fifty percent of the male swimmers (N = 4) were found to be deficient in Vitamin A. Twenty-five percent of the male swimmers (N = 2) were deficient in thiamin while 12 percent (1) were deficient in phosphorous and iron. Further inspection indicated that only 25 percent (N = 2) of the male swimmers had an adquate dietary intake.

Table III contains a similar breakdown for the 6 female swimmers. Eighty-three percent (N = 5) of the female swimmers were found to be deficient in calcium while 67 percent (N = 4) were deficient in iron and vitamin A. A further breakdown indicated that 17 percent (N = 1) had a dietary deficiency in phosphorus, thiamin and riboflavin. In fact, only one female swimmer had an adequate dietary intake. Thus, inspection of individual diets suggests a totally different picture than inspection of the means.

TABLE 1

Mean Nutrient Intakes Compared with RDA and Suggested Minimum-Maximums

	Men	Recommended	Women	Recommended
Age	15.25		15.16	
Ht	177.17 cm		171.45 cm	
Wt	52.26 kg		52.77 kg	
Kcal	6001		2534	
N	8		6	
Protein (gm)	175.38	54.0	97.81	46
Calcium (mg)	1512	1200	830	1200
Phosphorus (mg)	3133	1200	1765	1200
Iron (mg)	50.96	18	17.63	18
Sodium (mg)	4792	185*	2435.5	185*
Potassium (mg)	6416	2500	4435	2500
Vitamin A (I.U.)	4901	5000	3560	4000
Thiamin (mg)	2.22	1.5	1.21	1.2
Riboflavin (mg)	3.12	1.7	1.59	1.4
Niacin (mg)	39.38	20.0	32.73	16
Vitamin C (mg)	190	45.0	212.5	45
Cholesterol (mg)	876	300**	451.30	300**
% Kcal from Linoleic Acid	3.90	2.0*	7.03	2.0*
% Kcal from Protein	13.19	15	15.58	
from Fat	32.65	30	37.38	
from Carbohydrate	56.69	55	47.86	

* = minimum ** = maximum

TABLE II

Male Deficient in Selected Nutrients

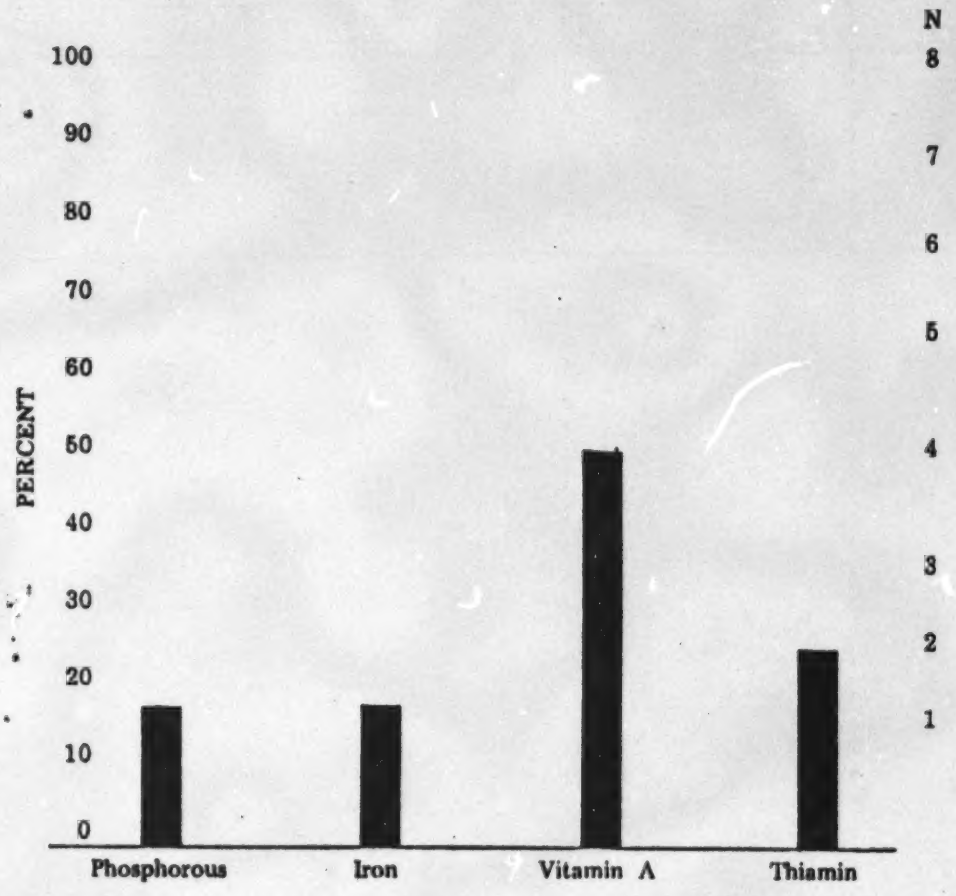
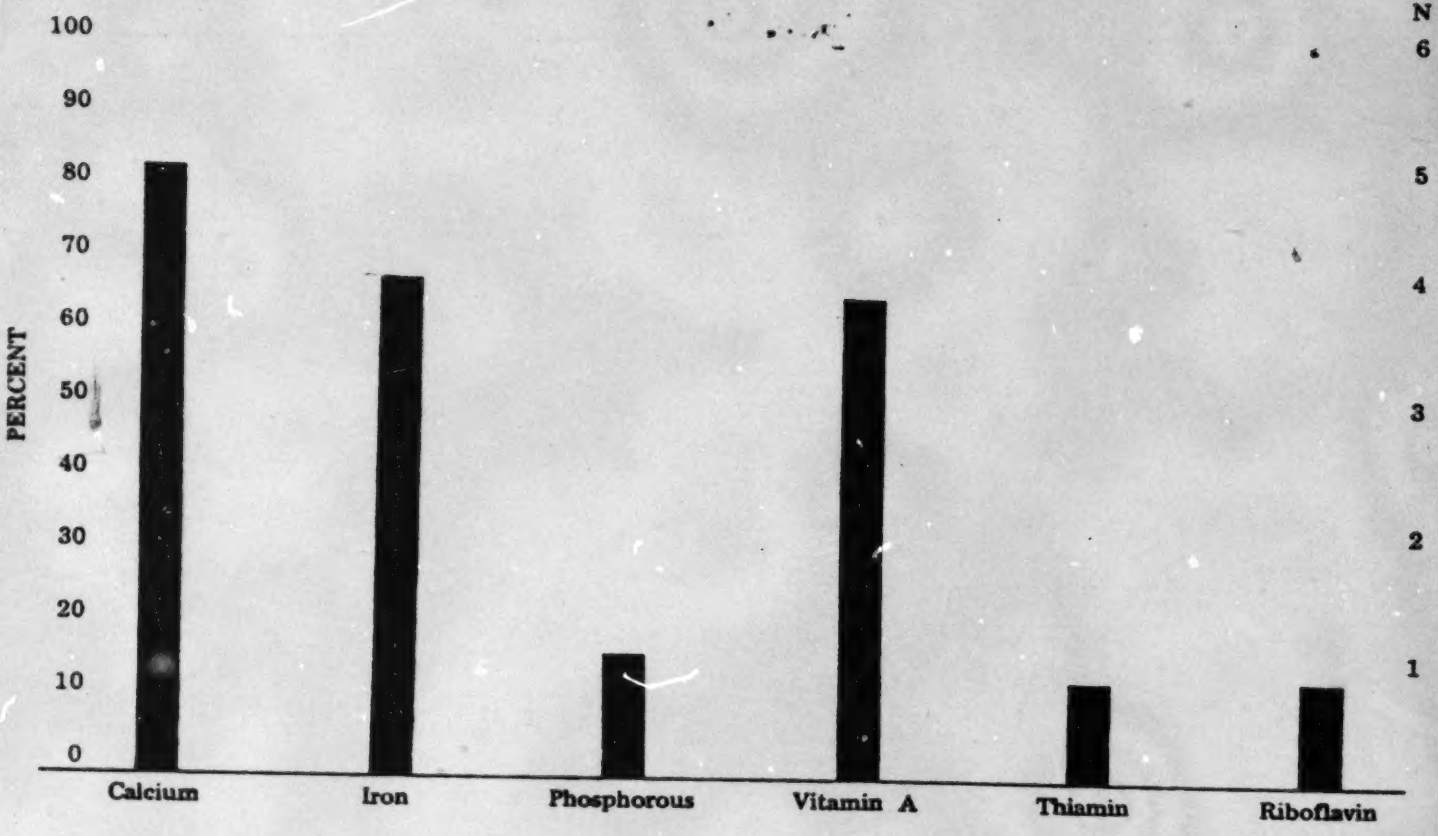


TABLE III

Females Deficient in Selected Nutrients



Discussion

When looking at the means for males and females across all categories the swimmers appeared to either meet or exceed the RDA's. However, a swimmer to swimmer analysis indicated that some swimmers were deficient in areas which could in fact affect their performance. This point was further verified in personal communication with the team's coach who indicated that three of the female swimmers who were low in caloric intake and other specific nutrients were having difficulty maintaining a high training level. Specifically, the coach reported that the swimmers were fatiguing early in their practice sessions. Additionally, even though their protein intake appeared to be more than adequate, the diet may be deficient in protein due to a negative caloric balance. This appears to be an important point not only from the standpoint of competition but from the standpoint of growth as these swimmers are still in their developmental stages. A follow up with the female swimmers indicated that they were so weight conscious that they were restricting their caloric intake in an effort to maintain body weight. Thus, it would appear that a coach may need to explain the relationship between caloric intake and energy expenditure to athletes performing heavy work loads.

Lane (2) in a recent study reported an increased need for potassium in athletes during heavy exercise in hot climates. The study indicated that athletes may need as many as 6000 mg. per day. The mean intakes for potassium for the Mobile swim team members were 4435 mg. for female team members and 6416 mg. for male team members. Therefore, if Lane is correct, several of the members of the Mobile swim team were deficient in potassium.

Van Dam (6) recently reported that due to the water solubility of the vitamin B complex there is an increased need for this group during heavy exercises. He further stated that even dietetically increased nutrition may not be sufficient to cover the vitamin need in active athletes. If Van Dam is correct, the results of the above mentioned dietary analysis may be under estimating the vitamin B complex needs of the swim team.

The relative high levels of sodium intake by the swimmers eating a normal diet, again raises questions about the practice of indiscriminately prescribing salt tablets. In addition, the high levels of cholesterol in the swimmer's diet raises the question of potential future health related problems.

Conclusion

For the swimmers studied, inspection of the diets revealed a variety of nutrient deficiencies for different individuals. Therefore, the coach or trainers should monitor the athlete's diet and adjust the diet or supplement only as necessary if optimal growth and achievement are to be accomplished.

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